



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Division of Remediation - Oak Ridge
761 Emory Valley Road
Oak Ridge, Tennessee 37830

September 21, 2018

Mr. John Michael Japp
Federal Facility Agreement Manager
Oak Ridge Office for Environmental Management
Department of Energy
P.O. Box 2001
Oak Ridge, TN 37831

Dear Mr. Japp:

TDEC Comment Letter

Design Characterization Completion Report for the Sitewide Groundwater Treatability Study at the East Tennessee Technology Park, Oak Ridge, Tennessee (DOE/OR/01-2768&D1)

The Tennessee Department of Environment and Conservation (TDEC), Division of Remediation, Oak Ridge Office has completed review of the *Design Characterization Completion Report for the Sitewide Groundwater Treatability Study at the East Tennessee Technology Park, Oak Ridge, Tennessee (DOE/OR/1-2768&D1)*.

In 2008, a two-phase groundwater treatability study was initiated to determine the effectiveness of insitu treatment technologies to remediate contaminated groundwater, including dense non-aqueous phase liquid (DNAPL) source areas at the East Tennessee Technology Park (ETTP) in Oak Ridge, Tennessee. This document reported on the Phase 1 portion of the project, defined as "the design characterization data identified as being necessary prior to moving to the Phase II pilot scale demonstration."

As referenced in Section 3.1 of this document titled "Purpose of Study," initially "TDEC concluded that a treatability study (was) warranted to further demonstrate the effectiveness of potential treatment technologies in the source areas prior to consideration of a TI waiver." In a triparty meeting held on February 21, 2018, the Department of Energy (DOE) provided description that in the time since this project was initiated, the effectiveness of thermal treatment in overburden and weathered rock units has been extensively proven via industry experience, and DOE was confident that this technique would work in those intervals. As such, there was no need to proceed with a pilot test in those zones. DOE also provided consultant testimony and detailed verbal description that DOE strongly believed that thermal treatment in the fractured rock at ETTP, under their proposed conditions, would provide strong potential for

uncontained DNAPL migration and would likely “do more harm than good.” At that time, the Environmental Protection Agency (EPA) requested additional information with regards to reference data supporting those determinations on the part of DOE, and TDEC stated that they would not direct a responsible party to conduct an activity that the principal investigator believes would make the contamination worse. Under no circumstances should TDEC’s agreement to cease continuation of this pilot test for thermal treatment in these fractured rock units be considered an agreement by TDEC that DNAPL in fractured rock (such as is seen at ETPP) is unmanageable or unrecoverable through a modified version of this or other potential remediation strategies. TDEC continues to stand by the statement and opinion identified in Section 3.1 of the above referenced document (also provided at the start of this project) that technical impracticability (TI) waivers will not be considered until evidence is provided to support the conclusion that remediation at the site is actually technically impracticable. This evidence has not been demonstrated at this time.

Following review of this document (with the higher-than-expected hydraulic conductivity values found within these zones, the defined upward groundwater gradients, the shallower than previously believed bulk of source materials, and the remedial technologies now available), TDEC is encouraged that the results strongly imply that removal of the majority of the contamination is now possible across ETPP.

In direct response to that February 2018 meeting and these discussions addressed above, in a letter dated July 19, 2018, the DOE established new milestones related to groundwater at ETPP. Those are listed as:

Final ETPP Main Plant Area Groundwater ROD

- Feasibility Study for Main Plant Area Groundwater at ETPP, September 30, 2019.
- Proposed Plan, February 13, 2021.
- Record of Decision, January 8, 2022.
- Remedial Action Work Plan will be placed in FY 2023 Appendix J without a date.

Both EPA and TDEC have requested participation in the development of the Feasibility Study (FS) deliverable.

The review of the *Design Characterization Completion Report for the Sitewide Groundwater Treatability Study at the East Tennessee Technology Park, Oak Ridge, Tennessee* (DOE/OR/1-2768&D1) by TDEC generated the following comments, questions and concerns related to the information provided in the document. Because this information will be used in conjunction with earlier site assessments to define possible remediation strategies for the site, these comments and questions were focused towards that goal.

General Comment

The document states that the subsurface in this area can be divided into three primary zones: "overburden (also referred to as the unconsolidated zone), weathered bedrock zone, and the fresh (competent bedrock)." Listed parameters for those zones were defined in the executive summary as including:

- Overburden (aka unconsolidated zone)
 - with an average thickness of 17 ft
 - ranging from 2.0 ft – 24 feet thick
- Weathered bedrock zone
 - With an average thickness of 8.8 feet
 - Encountered at depths from 2.5-24 feet bgs
- Fresh (competent bedrock) zone
 - With an average depth of encounter of 25.8 feet
 - Encountered at depths ranging from 20-34 feet bgs

KEY POINT: Because remediation options and assessment of techniques in planning meetings have tentatively been proposed surrounding these 3 specific units, TDEC requests clarification regarding how definition/delineation of these primary zones was made. If applicable, TDEC requests consideration of an additional zone to be included to be comprised of Fractured Bedrock. It appears that much of the bedrock in this assessment may support differentiation into a fractured bedrock category rather than a category called only "fresh (competent bedrock)."

Specific Comments

1. Please provide a list or table of characteristics of the zones or intervals that are being used to separate the lithology at the site. Please define the specific parameters of the characteristics that were used to determine delineation of the zones. This will be useful to understand the organization of the data here and to be able to speak to the next steps of remediation options in the upcoming FS.
2. For the weathered bedrock zone, please provide guidance to the listed parameters that were used to characterize this zone.
 - a. Please provide additional explanation regarding how the range of thickness was determined.
 - i. It appears that the regolith (saprolitic or similar) zone was included with overburden (potentially because in most instances it can be excavated with the source materials). Is this the intent for inclusion?
 - b. Please provide fracture characterization information with the applicable zone to support remedial technology selection. This may include parameters that separate the highly fractured zone from the "fresh competent bedrock" unit (i.e. fracture densities, RQDs, fracture apertures, etc.). A table or similar list of parameters or decision criteria would be very useful here. Table 6.1 provided depths but not explanation of decision criteria.

3. Please describe how voids or loss of recovery zones are described in the conceptual site model (CSM) with respect to the units that will be addressed when evaluating remediation technologies. Which zone are they incorporated with? How are they handled in the modeling? Are they addressed as fractures, voids, or something else?
4. This document refers generally to fractured bedrock at depths of 100 ft bgs – this depth and the ranges listed above implies it would be in the fresh (competent bedrock) zone, but the fractured description implies it is not fresh or competent. Please provide clarification.
5. On page 6-1, under the CSM, there is further description that fracture apertures identified in geophysical logging decrease in size with depth and that hydraulic conductivity from slug tests shows a decrease in K with depth consistent with decreasing fracture apertures. It is not clear how this was incorporated into the model. As discussed above please provide parameters.

Comments related to the characterization and delineation of the Constituents of Concern (COCs)

6. DNAPL source materials identified at the K-1401 area are listed to consist of TCE with Freon 113, cis-1,2 dichloroethene and tetrachloroethene and PCB (Arochlor-1254 – in concentration of 1200 mg/l). Soil/rock concentrations of TCE as high as 4,200,000 ug/kg were identified (as listed in Section 6-2 the Updated Conceptual Site Model). It appears that Aroclor 1254 may not have been included in the initial sampling program. Please review why it was left out of the COC list in spite of its identification at the site in the raw DNAPL sample. Were other soil samples or archived core samples assessed for PCBs prior to disposal of the core material? Is there a plan for that to allow delineation of that COC prior to generation of the FS? If data is available, please provide that data.
7. Initial groundwater samples from the GWTS wells show that high concentrations of TCE are present in groundwater within the GWTS area. Concentrations of TCE range from 0.37 ug/L at the boundary well (BR-06-2) to 370,000 ug/L at the DNAPL delineation well DZ-11. Are interim plans present to manage this source in the near term to prevent migration?
8. Based on estimates of TCE mass using the soil/rock concentrations, approximately 50% of the mass resides in the top 25 ft bgs in the core area of contamination. The bulk of the remaining mass below 25 ft is found in the 25 to 45 ft bgs interval (Section 6. UPDATED CONCEPTUAL SITE MODEL, page 6-2). During the planning meetings for the FS or under letter, please provide an update regarding the identified source areas and how the excavation of those sources under the interim RODs currently being executed has affected these zones. TDEC is pleased to see that the bulk of the constituents of concern identified in this document were found at relatively manageable depths in relatively manageable lithologies (i.e. overburden, weathered materials or in weak or very friable bedrock).

9. While the estimate of TCE mass provided in the executive summary is interesting with respect to TCE DNAPL identified during drilling activities, it is not relevant for comparison to historical estimates. It would also not be accurate to presume it was representative of the full mass of DNAPL TCE impact in this area. The calculation appears to have been derived from samples collected through roto-sonic drilling techniques, which due to the processes of operation can generate extreme heat which can provide false reductions of VOCs in those samples. Also calculations that do not include dissolved phase estimates or estimates of residual DNAPL in fractures are not complete in their representation of the current site conditions. Is there a comparison calculation that incorporates all phases of the COCs to define impacts to the site?

Graphical Data Representation Concerns / Comments

10. The Appendix C geophysical logs can be very difficult to read due to font size in the printed version of the report, TDEC is interested in seeing this information in more readable format to allow for better evaluation of the information.
11. Monitoring well installation logs don't provide information on well diameters, configuration, material types, etc. Is that information available under other cover?
12. Boring logs provide % sample recovery numbers that appear to be inconsistent with other descriptors, (e.g. along sections that show no recovery). The description's section, however, is very good and very helpful.
13. Cross sections would be very helpful. Those provided on page 6-4 were difficult to read (very small) and as such difficult to correlate to the base map.
14. It would be helpful to see maps or the computer outputs correlating the identified high VOC and DNAPL zones (from Oil Red O, Color Tec, as well as the Flute delineation techniques) digitally or in a meeting during the FS planning phase to more fully appreciate the information. It can be difficult to fully interpret the screen shot output that is able to be provided in the document.
15. On Figure 5.24, PW-2 needs additional description regarding the visual representation of conditions.
16. On Figure 5.29, at the bottom of the graphic, there is a typo on the contour line defining elevation. 778 should be 777.

TDEC appreciates the work that went in to this document and the evaluation of the data provided. TDEC looks forward to continuing to support the groundwater clean-up goals at ETPP.

Please feel free to reach out to Heather Lutz should you have any questions or concerns regarding this letter. She can be contacted via email at heather.lutz@tn.gov or phone at 865-220-6574.

Sincerely

A handwritten signature in black ink, appearing to read 'Randy Young'.

Randy Young
FFA Project Manager

xc: Karen Deacon, DOE
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